4.0 ENVIRONMENTAL IMPACT ASSESSMENT METHODOLOGIES AND ASSUMPTIONS

This chapter discusses the methods and assumptions associated with the evaluation of the proposed conveyance or transfer of the subject land tracts. Section 4.1 contains discussion of the factors affecting the general issues presented in the CT EIS and the overall evaluation process. Section 4.2 presents the methodology and assumptions used in the analysis of each environmental resource and the associated impacts.

4.1 General Evaluation Process and Issues

4.1.1 Format Considerations

The decision process set by Public Law (PL) 105-119 (the Act) requires some minor changes to the EIS format. The Council on Environmental Quality (CEQ) regulations for implementing the NEPA direct Federal agencies to follow the standard format contained in 40 Code of Federal Regulations (CFR) Parts 1550-1508 for preparation of an EIS. However, the regulations allow Federal agencies to use different formats if "the agency determines that there is a compelling reason to do otherwise" (40 CFR 1502.10). Due to the complex, interwoven nature of the decision process contained in PL 105-119, the timing of the different decisions and determinations, and the number of land tracts being discussed in this CT EIS, the DOE has determined that a modified format would better serve the public interest and more efficiently satisfy the regulatory requirement for clear presentation of information.

Given the uncertainty associated with the conditions of conveyance or transfer of each individual tract, this CT EIS has been formatted to provide an individual discussion of the environment of each tract. Chapter 1 provides an introduction to the DOE's role in the conveyance and transfer process, the purpose and need for the DOE's action, and an overview of the alternatives analyzed in this CT EIS. Chapter 2 describes the Proposed Action Alternative and other alternatives considered in detail, as well as the contemplated land uses for each tract. Impacts of the No Action Alternative and the Proposed Action Alternative implementations are summarized in Table 2.4-1. The overall aspects of the environment common to all tracts are discussed in Chapter 3. Chapter 4 discusses the perspectives, assumptions, and methodologies by which the general issues and each of the environmental aspects and the associated impacts were assessed. Chapters 5 through 14 discuss each land tract separately. Each of these chapters discusses the legal or real estate description of the individual land tract, the land use(s) contemplated for the tract, unique aspects of the tract's affected environment, and the potential environmental impacts estimated to result from the postulated use and development of the tract.

4.1.2 Direct Versus Indirect Impacts

Once the land tracts are conveyed or transferred they will pass beyond the administrative control of the DOE, and all subsequent use of the land will be independent of the DOE. Therefore, for the purpose of this CT EIS, all actions and their associated impacts that would be undertaken by the DOE due to the proposed conveyance and transfer of the land tracts are described as direct impacts. An example of direct impacts would be the impacts of moving personnel from the DOE Los Alamos Area Office (LAAO) building to another facility at LANL.

All subsequent actions and their associated impacts that would be undertaken by the recipients after the proposed conveyance or transfer of the land tracts are described as indirect impacts. An example of an indirect impact would be increased water demand from new development and use of a tract.

4.1.3 Timeframe of Analyses

The schedule for conveyance or transfer of each tract, either in whole or in part, and the potential recipient's eventual development of the tracts cannot be accurately determined at this time. Therefore, the relationship of those schedules to the schedule for full implementation of the activities described in the LANL SWEIS Preferred Alternative also cannot be evaluated. In order to provide bounding analyses, it is assumed in this CT EIS that the SWEIS Preferred Alternative has already been fully implemented and all of the tracts are conveyed or transferred and developed within the next 10 years. This assumption, while ensuring the analyses of impacts bounds those likely to occur, may be overly conservative in some cases. Those cases where the analyses may be overly conservative (for example, in estimating when utility demand may exceed capacities), are identified in the following chapters.

4.1.4 Global Development Assumptions

Evaluation of resource impacts (utilities, air, transportation, etc.) for the Proposed Action Alternative required that development conditions be defined or assumed. These conditions include acreage to be developed, type of development (none, residential, commercial, mixture), number of new dwelling units or businesses, number of new residents or workers, and number of new vehicles. Estimates of the development acreage reflect the best available information on the footprint of contemplated developments. This acreage may include the redevelopment of disturbed land, as well as the new use of relatively undisturbed areas. The impact analysis assumes that these footprints represent an approximation of areas that would be developed but that may not include all areas that would otherwise be disturbed. Likewise, there are no specific acreage estimates for land that may be disturbed or developed for land uses that include undefined improvements to utilities or recreational areas. These areas are qualitatively addressed in the impact analysis.

Both potential recipients of the tracts proposed for transfer were consulted as to their plans for use of the tracts. Neither Los Alamos County nor San Ildefonso Pueblo has development plans for 4 of the 10 tracts: Miscellaneous Site 22, the Miscellaneous Manhattan Monument, the White Rock Y, and Technical Area (TA) 74 Tracts. Three other tracts have but a single development scenario, and the remaining three have two possible development scenarios.

Tracts with a single development scenario include Rendija Canyon, TA 21, and the Airport Tracts. If developed, the Rendija Canyon Tract will become the site of a small community with nearly 1,300 new homes and 3,500 new residents. TA 21 also has one development scenario: commercial and industrial use of 55 acres (22 hectares), which would have been cleared of existing site buildings prior to new development. The Airport Tract also would be destined for commercial and industrial use, in addition to its continued use as an airport. No buildings would be demolished prior to disposition to accommodate the Airport Tract's continued use as an airport facility.

Tracts with two possible development scenarios include DOE LAAO, DP Road, and the White Rock Tracts. Under one development scenario, the DOE LAAO Tract would continue to be used commercially; private firms would supplant the DOE in the

existing office building (6 businesses, 120 new employees). The DOE LAAO Tract also may be developed residentially; however, in this case both site buildings would be razed and replaced by 200 dwelling units and 500 new County residents. The DP Road Tract might be developed commercially (40 businesses, 900 new workers), or it could receive a mixture of residential development (160 mobile homes on 20 acres [8 hectares]) and commercial development on 5 acres (2 hectares) (10 businesses, 225 new employees). It is expected that the two site buildings would remain intact and not be razed prior to disposition. Finally, the White Rock Tract could receive minimum commercial development (four businesses on just 8 of 100 acres [3 of 40 hectares] of land), or receive a mixture of residential and commercial development. Plans for the latter include 760 new dwelling units (1,900 new residents) and a 20-acre (8-hectare) recreational vehicle park with capacity for 160 vehicles. Table 4.1.4-1 summarizes information about these potential development scenarios; Table 4.1.4-2 summarizes the assumed structure status at the time of conveyance or transfer. It is assumed that any leases will transfer with the conveyance or transfer of each tract. Only permanent buildings and structures belonging to the DOE would be subject to decontamination; only DOE-owned structures not under lease would be subject to demolition activities.

4.2 Environmental Impact Methodologies

The resource areas and issues addressed in the analysis of the conveyance or transfer of each of these tracts are as follows:

- Land Use
- Transportation
- Infrastructure
- Noise
- Visual Resources
- Socioeconomics
- Ecological Resources
- Cultural Resources
- Geology and Soils
- Water Resources
- Air Resources
- Human Health
- Environmental Justice

A detailed discussion of the specific methodologies and assumptions for each of these areas is provided in the following sections, as appropriate.

4.2.1 Land Use

The approach used in assessing potential impacts to land use is comparative in nature. Impacts are identified based on determinations of compatibility between land use reasonably anticipated to occur as a result of the Proposed Action Alternative; existing adjacent land uses; and management plans, policies, and practices.

Consistency and compatibility of future land use with both ongoing DOE and non-DOE management plans, policies, regulations, and practices are assessed also. Examples of DOE management plans and policies include those related to resource management, public safety, and national security for tracts located adjacent to ongoing LANL operations. Non-DOE plans and policies include related resource management plans and policies for wildlife, parks and monuments, and fire control (for example, by the National Park Service [NPS] and U.S. Forest Service [USFS]). Examples of relevant land use practices include public use of lands adjacent to the tracts for recreational purposes such as hiking, biking, or viewing of wildlife.

Table 4.1.4-1. CT EIS Development Assumptions

TRACT[a]	ACRES (HECTARES)		RESIDENTIAL			COMMERCIAL/INDUSTRIAL		
	Total	Developed	Homes[b]	Residents[c]	Vehicles	Businesses[d]	Workers	Vehicles
Contemplated Land Use:								
Rendija Canyon[e]	910 (369)	570 (231)	1,260	3,500	2,900	0	0	0
DOE LAAO	15 (5)	10 (4)	200	500	420	0	0	0
DP Road	50 (20)	26 (11)	0	0	0	40	900	24
TA 21	260 (99)	55 (22)	0	0	0	70	1,900	56
Airport	205 (80)	105 (43)	0	0	0	200	3,100	120
White Rock[f,g,h]	100 (40)	60 (24)	760	2,220	1,730	1	6	0
	1,540 (613)	826 (335)	2,220	6,220	5,050	311	5,906[i]	200
Alternate Land Use:								
Rendija Canyon[j]	910 (369)	0 (0)	0	0	0	0	0	0
DOE LAAO	15 (5)	10 (4)	0	0	0	6	120	15
DP Road[k]	50 (20)	26 (11)	160	400	330	10	225	6
TA 21			No alternate land use contemplated.					
Airport			No alternate land use contemplated.					
White Rock	100 (40)	8 (3)	0	0	0	4	60	2

[a] Remaining four tracts are not developed: Miscellaneous Site 22, Miscellaneous Manhattan Monument, TA 74, and White Rock Y.

[b] Homes = Dwelling units (houses, apartments, condominiums, or mobile homes).

[c] Residents estimated at the County average of 2.5 per dwelling unit.

[d] Businesses: May be more than one business per structure (several firms in an office building).

[e] Assumes 420 acres (170 hectares) at three homes per acre (hectare), and 148 acres (60 hectares) for streets, etc.

[f] Commercial development consists of RV park (20 acres [8 hectares]) with 160 spaces.

[g] "Residents" are the sum of 1,900 new residents plus 320 average occupancy of the RV park.

[h] Vehicles include 130 RVs (average occupancy of the RV park).

[i] Of 5,900 workers, 3,900 (two-thirds) live in new developments.

[j] Alternate "development" is cultural preservation.

[k] Alternate scenario: Trailer park (160 units) on 20 acres (8 hectares) + 10 businesses on 6 acres (2.4 hectares).

Table 4.1.4-2. Assumed Structure Status at Time of Conveyance or Transfer

TRACT STRUCTURES	LAND USE #1	LAND USE #2
Rendija Canyon:	Residential	Preservation
Los Alamos Sportsman's Club	Intact	Intact
Other Club structures	Intact	Intact
Residences	Intact	Intact
Utilities[a]	Intact	Intact
Environmental[b]	None	None
DOE LAAO:	Commercial	Residential
Office building	Intact	Razed
Steam plant	Intact	Razed
Sewage lift station	Intact	Intact
Utilities[a]	Intact	Intact
Environmental[b]	None	None
Miscellaneous Site 22:	Commercial	
Air monitoring station	Removed	NA
Miscellaneous Manhattan Monument:	Preservation	
Monument	Intact	NA
DP Road:	Industrial	Residential
Buildings (2)	Intact	Intact
Storage sheds (7)	Intact	Intact
Utilities[a]	Intact	Intact
Environmental[b]	Removed	Removed

TRACT STRUCTURES	LAND USE #1	LAND USE #2
TA 21:	Industrial	
Structures (more than 100)	Razed	NA
Utilities[a]	Intact	NA
Environmental[b]	Removed	NA
Airport:	Commercial	
Terminal	Intact	NA
Storage (2)	Intact	NA
Gas meter	Intact	NA
Utilities[a]	Intact	NA
Environmental[b]	Removed	NA
White Rock Y:	Utilities	Preservation
Utilities[a]	Intact	Intact
Environmental[b]	Intact	Intact
TA 74:	Utilities	Preservation
DOT facilities	Intact	Intact
Utilities[a]	Intact	Intact
Environmental[b]	Intact	Intact
White Rock:	Residential	Preservation
Visitor Center	Intact	Intact
Electrical substation	Intact	Intact
Water pump station	Intact	Intact
Utilities[a]	Intact	Intact
Environmental[b]	Removed	Removed

Notes: NA = not applicable, DOT = U.S. Department of Transportation

[a] Utilities: water, electric, gas, sewage lines/equipment, etc.

[b] Environmental: air monitoring station, thermoluminescent dosimeter station, monitoring well, stream gauging station, outfall.

Ten parcels of land, or tracts, have been initially identified as suitable for conveyance or transfer. The two potential recipients of these lands tracts have been consulted as to their plans for use of these tracts. These plans are at a preliminary stage and encompass a range of potential land uses. Because the decision as to which recipient will receive each tract will be made by the Pueblo of San Ildefonso and the County of Los Alamos after the completion of this CT EIS, the DOE cannot determine which land use might be implemented on any land tract. In order to appropriately analyze the two land uses, the impacts of the contemplated uses were both analyzed in the CT EIS.

4.2.1.1 Environmental Restoration

PL 105-119 directed, in part, that the DOE identify land at LANL for conveyance and transfer. The Act also directed that the DOE identify any environmental restoration or remediation that would be necessary prior to conveyance or transfer of candidate land tracts. In response, the DOE has prepared a report (DOE 1999b) to provide Congress with information needed to make decisions about actions and funding needed for characterization and cleanup of the candidate tracts of land. Information contained in the environmental restoration sections of this CT EIS, including Appendix B, is summarized from the Environmental Restoration Report.

The LANL Environmental Restoration Report (DOE 1999b) identifies potential and confirmed environmental contamination (that is, potential release sites, or [PRSs]) at each land tract; identifies buildings and other structures located within each tract; identifies canyon system areas of concern; and stipulates whether additional sampling or characterization is likely. The LANL Environmental Restoration Report identifies remedial actions likely to prove necessary in order to ready a tract of land for conveyance or transfer and projects the cost and duration for these cleanup activities. Three site cleanup techniques are considered: removal, in situ treatment, and in situ containment of the contamination. Two cleanup techniques are assumed for structures: removal of hazardous materials (such as asbestos insulation) or complete demolition of the structure. Cleanup of canyons systems is assumed to be removal of contaminated soils. Because the details of potential remediation actions are not known at this time, numbers of remediation workers, individual remediation tasks, and duration of each task cannot be determined. Therefore, quantitative risks to remediation workers are not assessed in this CT EIS. Appendix B, Environmental Restoration Data, summarizes this information, but the Environmental Restoration Report should be reviewed for more detailed data. Maps of the 10 subject tracts are included in Chapters 5 through 14 that show, broadly, the areas of each tract where potential contamination issues (PCIs) are located and the areas without PCIs. These maps were furnished by LANL Environmental Restoration (ER) Project personnel for inclusion in the CT EIS. The PCI maps are intended to illustrate the areas of each tract that include the PRSs, contaminated structures, and soil or silt areas that are contaminated either from air or water disbursement. The PCI areas have deliberately been exaggerated beyond the specific location of individual PRSs or known sites of contamination to accommodate the special requirements needed to perform future cleanup activities (which include worker and equipment staging areas, barrel storage areas, site egress requirements, health and safety buffer areas, etc.) and to compensate for site areas that have not been completely investigated or that may not have been field sampled yet (although site contamination is suspected from past uses of the areas or from information known to the LANL ER Project). Therefore, the PCI areas do not reflect actual total site contamination, nor are they intended

to do so. Some of the PCI areas reflect site areas that have already been cleaned up but that have not been approved for release to use by the site administrative authority(s).

4.2.2 Transportation

The techniques recommended by the Transportation Research Board's *Highway Capacity Manual Special Report 209* (NRC 1994) are used to evaluate the level of service (LOS) of each transportation link. The LOS is a qualitative measure describing operational conditions within a traffic stream. An LOS describes these conditions in terms of factors such as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety. The LOS designations range from A to F, with each level defined by a range of volume to capacity ratios. The LOS designations given in Table 4.2.2-1 are based primarily on the Highway Capacity Manual (NRC 1994).

Each transportation link or section is evaluated for two conditions. The first analysis assumes that the proposed disposition of each tract does not take place (the No Action Alternative). The second analysis considers the impacts of the disposition of the tract with the proposed land use(s) as currently contemplated. This allows an evaluation of the potential transportation impacts on the transportation link of the proposed land use(s) of the tract.

The trips generated at each tract for the bounding case land use are estimated. This is done using the procedures of the Institute of Transportation Engineers (ITE) *Trip Generation Manual* (ITE 1997). The trips generated at each tract are then added to the

Table 4.2.2-1. Level of Service Letter Designations and Definitions

LETTER DESIGNATION	OPERATING CONDITIONS	LEVEL OF SERVICE DEFINITION
A	Good	This is a condition of free vehicle flow, accompanied by low volumes and high speeds.
B	Good	This occurs in the zone of stable vehicle flow, with operating speeds beginning to be restricted somewhat by traffic conditions.
C	Good	This is still the zone of stable vehicle flow, but speeds and maneuverability are more closely controlled by the higher volumes.
D	Below average	This LOS approaches unstable vehicle flow, with tolerable operating speeds maintained, though considerably affected by changes in operating conditions.
E	Maximum capacity	This cannot be described by speed alone, but represents operations at lower operating speeds, typically, but not always, in the neighborhood of 30 miles (48 kilometers) per hour, with volumes at or near the capacity of the highway.
F	Traffic jam	This describes a forced-flow operation at low speeds, where volumes are above capacity.

Source: NRC 1994

existing trips on the adjacent transportation system link, and these form the basis for the contemplated land use capacity analyses discussed above.

Background traffic growth rates and the anticipated annual rate of growth of existing traffic are estimated in conjunction with the New Mexico State Highway and Transportation Department (NMSH&TD) and County officials. These background traffic growth rates are applied to the existing traffic counts provided by the County and NMSH&TD to forecast future traffic levels for the baseline (no land disposition) added to this forecast background traffic to evaluate the contemplated land use scenario. An assumption of this analysis is that as background development occurs in the region, localized improvements would be made to accommodate this increased level of traffic.

To assess the indirect impacts of the proposed conveyance or transfer, existing County traffic is projected to increase at a rate of 1.5 percent per year. The County's Traffic Engineering Department provided this growth rate projection. The NMSH&TD Transportation Planning Division provided a growth rate of 2.29 percent for use on the traffic counts (NMSH&TD 1997).

4.2.3 Infrastructure

The approach taken in assessing potential impacts to utilities is comparative in nature. Potential impacts are identified by comparing the existing infrastructure and utility usage and capacities with the estimated needs for no action and proposed future land uses. Utilities considered in the analysis include electricity, water, natural gas, wastewater, and solid waste. Utility needs for each tract were estimated by multiplying the average unit's (dwellings or business) utility requirements by the contemplated number of dwelling units (residential) or businesses (commercial and industrial) to be developed. The average unit utility requirements were derived from actual County and LANL utility usage figures.

Cumulative utility usage includes the sum of contemplated developments on transferred lands, the County's ongoing and future developments on tracts currently under County ownership, and anticipated growth of LANL. The sum of contemplated developments on transferred land includes only one land use scenario from each tract—that is, the scenario that has the highest overall anticipated utility usage. LANL growth is based on the Preferred Alternative of the LANL SWEIS (DOE 1999c).

4.2.4 Noise

The analysis of the impacts of noise and vibration examines projected activities at each of the land tracts, with a focus on changes from existing conditions in the area. The analysis is qualitatively estimated using comparative values shown on the decibel chart provided as Table 3.2.4-1 in Chapter 3.

4.2.5 Visual Resources

Visual resource analyses address those aspects of an area or project that pertain to its appearance and the manner in which it is viewed by agencies and individuals. Visual resource studies review the aesthetic qualities of natural landscapes and modifications to them, the perceptions and concerns of people for the landscape and landscape change, and the physical or visual relationships that influence the visibility of proposed landscape changes.

The inventory method for this CT EIS will follow an approach developed and used by the U.S. Department of the Interior, Bureau of Land Management (BLM), called Visual Resource Inventory (VRI) (DOI BLM 1986). This inventory provides a means for determining visual values. The major components of the VRI methodology include scenic quality, distance zones, and sensitivity

levels. These components are individually evaluated and are combined into a ratio of one of four VRI classes. VRI classes represent the relative value of visual resources present and provide a basis for considering visual values during the planning process.

The BLM methodology is used to evaluate the contemplated land uses by measuring the degree of contrast between the proposed activity and the existing landscape. This score is compared with allowable levels of contrast for the appropriate management class. The comparison helps to determine if mitigation may be necessary to reduce visual impacts. The mitigation techniques most appropriate for the project will best be determined when final development proposals for buildings and other facilities are available. However, general suggestions for mitigation techniques can be discussed on a tract-by-tract basis.

Visual resource analysis data for the CT EIS were collected during site visits in August 1998. Other information was obtained through various documents and maps.

VRI Class I is assigned to all special areas where there is a congressional or administrative decision to maintain a natural landscape as essentially unaltered by humans. The objective of this class is to preserve the existing character of the landscape.

VRI Class II, III, and IV assignments are based on a combination of scenic quality, distance zones, and sensitivity levels. The highest scenic quality areas that do not have an administrative designation are assigned to Class II. The objective of this class is to retain the existing character of the landscape, and any changes to the characteristic landscape should be low. For Class III areas, the objective is to partially retain the existing character of the landscape and to make only moderate changes to the landscape. Class IV areas represent the lowest value of visual character; the level of change to the characteristic landscape can be high, but attempts should be made to minimize further visual impacts.

4.2.6 Socioeconomics

The total socioeconomic impact to the region of influence (ROI) is the sum of direct, primary indirect, and secondary indirect impacts. Both the direct and indirect impacts were estimated for the ROI described in Chapter 3, Section 3.2.6, of this CT EIS. Because economic impacts affect a large, economically linked area, no tract has a specific ROI. Impacts for all tracts are assessed for the three-county ROI.

Economic impacts are based on the development assumptions stated in Section 4.1.5. Direct employment impacts represent actual increases or decreases in employment at each tract. Total employment and earnings impacts were estimated using Regional Input-Output Modeling System (RIMS II) multipliers developed specifically for the ROI by the U.S. Bureau of Economic Analysis.

The significance of the actions and their impacts is determined relative to the context of the affected environment. Conditions in the ROI, as presented in Chapter 3, Section 3.2.6 of this CT EIS, provide the framework for analyzing the significance of potential socioeconomic impacts that could result from implementation of any of the alternatives. Employment and population figures represent socioeconomic conditions expected to exist in the ROI through the year 2025.

4.2.7 Ecological Resources

Impact analysis methods and thresholds were developed in concert with Cooperating Agency personnel and other local ecological resource experts. Each subject tract is more fully described in Chapters 5 through 14 in terms of watershed, vegetation zone(s), fauna, and presence or use of the tract by protected

or sensitive species. Each land tract was field verified to ensure accuracy of descriptive data. This information provides the foundation data for impact analysis for the Proposed Action Alternative and the No Action Alternative.

Potential impacts to most species are assessed qualitatively and in the general categories of direct mortality from construction, habitat loss, degradation of habitat, potential impacts that would occur after development, and loss of LANL's habitat management and protection plans and their implementation. Impacts to Federal-listed species' are species-specific and primarily determined through an assessment of effect to the species' areas of environmental interest (AEIs) that occur within a tract proposed for development. Any reduction or modification to a species' AEI core zone is considered an adverse impact. The severity of impact to a Federal-listed species resulting from reduction or modification of its AEI buffer zone(s) is dependent upon the proposed land tract scenario. Tract-by-tract information is not available for those Species of Concern, a category for plants and animals that the U.S. Fish and Wildlife Service encourages agencies to include in their NEPA analysis. Therefore, these species are not specifically addressed in the potential environmental impact sections.There is the potential for impacts to the State-listed species presented in Table 3.2.7-1 in Chapter 3 as a result of the proposed actions, either through direct mortality or habitat degradation. However, there is insufficient information on the actual distribution and abundance of these species to make an accurate tract-by-tract assessment of the potential effects from the Proposed Action Alternative (LANL 1998b). Therefore, these species are not specifically addressed in the potential environmental impact sections.

4.2.8 Cultural Resources

The potential for negative or positive impacts to cultural resources are assessed under the No Action Alternative and the Proposed Action Alternative (conveyance and transfer of each tract). Cultural resources that could be directly or indirectly affected by the alternatives are those located on lands within the 10 subject land tracts and in areas surrounding these tracts. Thus, the ROI for cultural resource impact assessment includes the land tracts themselves, plus cultural resources located in surrounding lands.

Cultural resources include prehistoric and historic resources, and traditional cultural properties (TCPs) (as detailed in Chapter 3, Section 3.2.8, and Appendix E of this CT EIS) that are located within the ROI. These resources include those that have been identified and those that could potentially be located within the ROI, such as subsurface archaeological deposits, unrecorded burials, and unidentified TCPs. All cultural resources are considered in the impact analysis; however, information on National Register of Historic Places (NRHP) eligibility of resources is provided for each of the 10 tracts.

Information on cultural resources is derived from the results of systematic cultural resource inventories of the 10 proposed land tracts and review of literature concerning TCPs and traditional uses of the area. A more detailed discussion of the methods employed to gather cultural resource data is provided in Appendix E of this CT EIS. Consultations with Native American tribes were not completed in time for inclusion into this CT EIS. Consultations will be completed prior to conveyance and transfer of any proposed tracts on a government-to-government basis in accordance with DOE Order 1230.2 (see Chapters 16 and 17 of this CT EIS).

Descriptions of activities occurring under the two alternatives are used to analyze

potential impacts to cultural resources. The results of consequence analyses for other resource areas (water resources, land resources, ecological resources, environmental restoration, infrastructure, transportation, land use, human health, visual resources, and noise) are used to determine the potential for other impacts to the cultural resources themselves and to traditional practitioners accessing TCPs.

Impacts are discussed as direct (resulting from the DOE's action of conveyance or transfer) and indirect (resulting from the broad categories of land use contemplated by the receiving parties). Potential impacts could be physical effects to cultural resources themselves, effects to people accessing the resources, and effects due to the change in the application of Federal protections to these resources.

Potential impacts to cultural resources are assessed using the "criteria of adverse effect" (36 CFR Part 800.5(a)(1)), as defined in the implementing regulations for the *National Historic Preservation Act* (NHPA) of 1966, as amended (16 United States Code [U.S.C.] Section 470). An adverse effect is found when an undertaking may alter the characteristics that qualify a property for inclusion in the NRHP. These criteria include physical destruction or alteration; removal of a property from its historic location; change of the character of a property's use; introduction of visible, audible, or atmospheric elements out of character with the resource; neglect leading to deterioration and vandalism; isolation and restriction of access; and transfer, lease, or sale of the property out of Federal ownership or control without adequate and legally enforceable restrictions or conditions to ensure long-term preservation of the property's historic significance. The State Historic Preservation Office(r) (SHPO) reviews NRHP eligibility and adverse effect determinations. Activities conducted under the alternatives will be compared against these criteria of adverse effect to determine the potential for impacts to cultural resources.

Potential impacts to TCPs and practices also are addressed in the context of the requirements of the *American Indian Religious Freedom Act*, the *Religious Freedom Restoration Act*, Executive Order 13007: "Indian Sacred Sites," and the *Native American Graves Protection and Repatriation Act*. These laws and executive order provide for Federal protections and considerations for TCPs and religious practices that may be lost or changed under the alternatives analyzed. Potential impacts could include the loss of access to TCPs by traditional practitioners, loss of ownership or control over human remains and certain items found in an archaeological context, the loss of protection for certain classes of resources, and burdens on the practice traditional religions.

4.2.9 Geology and Soils

The methodology used to assess potential impacts to geology and soils is a two-step process. First, past activities are evaluated to see how they have impacted the geology and soils in the study area. The information from this study on the existing environment is presented in Chapter 3, Section 3.2.9. Information from Section 3.2.9 was then used as a basis for assessment of potential impacts that may result from implementing the Proposed Action Alternative and the No Action Alternative. The geology and soils impact analysis focuses on any changes that have the potential for being impacted by seismic events and slope instability, causing soil erosion and changes to mineral resources. For example, observation and studies of the sites in the past have shown where slope stability problems are most likely to occur and under what circumstances. This type of information is used to see if those same indicators leading to soil erosion were present in a new action or in a potential change to an existing activity. This manner of analysis is

commensurate with the significance of the potential impacts in this resource area.

Impacts to geology and soils are primarily associated with effects generated by proposed construction activities. Where construction activities would occur outside of existing facilities, they are explicitly addressed.

The effects on soil contamination from contaminants released to the atmosphere, either directly in gaseous effluents or indirectly from resuspension of onsite contamination (for example, fugitive dust), were evaluated. As discussed in Chapter 3, Section 3.2.9, the information provided from the geology and soils studies related directly to the analysis of several other sections within the CT EIS (such as cultural resources, human health, and accidents).

4.2.10 Water Resources

Impacts to water resources are assessed for both the No Action Alternative (continued DOE operations) and the Proposed Action Alternative. Each tract is assessed separately, although cumulative impacts also are considered. Impacts in each tract are assessed separately. In some cases water quality data were not available for the individual tracts. Impacts on the following water resources are assessed:

- Surface water quality (including National Pollutant Discharge Elimination System [NPDES] discharge points)
- Surface water quantity
- Groundwater quality
- Groundwater quantity

Changes in water quality and quantity are described and quantified where information is available. The assessment of potential impacts to water quality includes a comparison of the chemistry of any proposed discharge or its applicable regulatory limits to the existing water. For instance, any proposed discharge to surface water is assessed to determine whether it would affect the quality of the surface water by increasing chemical contaminants (such as nitrate) or water parameters (such as total suspended solids). The effect of changes in surface water discharge on transport of sediments and related contaminants is evaluated also.

Impacts on water quantity are most likely to exist in the form of withdrawals of groundwater for drinking water supplies, although surface water uses also may be planned or result from proposed alternatives. Changes that affect 100-year and 500-year floodplain configurations or that place structures or barriers in historic floodplains are evaluated, as well as any other increases in surface water flow (such as NPDES inputs) that may cause water and contaminants to reach the Rio Grande.

4.2.11 Air Resources

For each alternative, the three categories of pollutants (criteria, hazardous, and radioactive) were each evaluated from two perspectives: contributions by LANL operations and contributions from activities subsequent to disposition of the land tracts. In the No Action Alternative, lands are not transferred and, hence, there are no contributions other than those from LANL operations. These contributions have already been calculated in the LANL SWEIS (DOE 1999c). In the Proposed Action Alternative (convey or transfer):

- Other contributions are estimated individually for each tract and for each contemplated use of each tract.
- LANL contributions are examined for changes from the estimates made in the LANL SWEIS.

For example, disposition of the White Rock Tract would place some members of the

public closer to operations at TA 54. Resulting exposures to radiological and chemical air pollutants are, therefore, reexamined.

4.2.11.1 Global Climate Change

A quantitative analysis was performed for emissions of carbon dioxide; other greenhouse gases are discussed qualitatively.

LANL emissions of carbon dioxide from stationary sources are estimated for combustion units on each tract of land being considered for conveyance or transfer. Estimates are based upon estimated annual fuel consumption by steam plants, boilers, and a natural gas water pump at TA 54 (DOE 1999c, Appendix B). Emissions from automobiles are estimated by assuming 4.3 tons (3.9 metric tons) emitted per private vehicle per year (DOE 1999c, page 5-19). The emissions are then summed for the No Action Alternative.

Under the Proposed Action Alternative (conveyance and transfer), LANL activities are replaced by activities of the contemplated land uses. Estimates of carbon dioxide emissions are made for residential and commercial activities, including vehicular emissions.

4.2.12 Human Health

4.2.12.1 General Considerations and Assumptions

Analysis for both CT EIS alternatives is limited to those human health impacts attributable to the DOE and LANL, with the exception of three natural phenomena initiated accidents or events that have area-wide concerns (floods, seismic events, and wildfire). The indirect human health impacts of the activities due to subsequent use by the land recipients are not addressed. This is because it is assumed that all uses after the conveyance or transfer will be in accordance with State and Federal laws and regulations that would be protective of workers and the general public. Also, no human health impact analysis was prepared for LANL ER Project activities (restoration, remediation, waste management, and decontamination and decommissioning) associated with the 10 subject land tracts or adjoining lands in the CT EIS. It is assumed that actions would be conducted in a manner consistent with all Federal and State regulations and, specifically, the DOE and LANL *Resource Conservation and Recovery Act* (RCRA) permit. It is additionally assumed that each land tract would be restored or remediated to a level of residual contamination (consistent with the requirements at the time of conveyance or transfer) that will assure a safe and healthy environment for the uses contemplated under the Act. This assumption may hold true for adjoining lands or upstream and upgradient lands that have potential contamination issues. The need to clean up these adjoining or upstream lands would be dependent upon risk assessment performed by LANL's ER Project during the planning stages of the remedial action. Those potential human health impacts that are addressed in this CT EIS are in the respective land-tract specific sections in Chapters 5 through 14.

4.2.12.2 LANL Operations

The CT EIS addresses the human health impacts of relevant activities associated with LANL operations. "Relevant" in this case means that an activity has the potential to affect the human health of those residing or working on the 10 subject land tracts. Human health impacts associated with LANL facilities and operations are addressed in detail in the LANL SWEIS (DOE 1999c). It should be noted that some LANL operations described in the LANL SWEIS project human health impacts to the public, which are not reflected in the land-tract specific human

health analyses because they are unrelated to the 10 subject land tracts.

In the LANL SWEIS, none of the LANL operations for any alternative are expected to produce radiological doses over the next 10 years that would result in any excess latent cancer fatalities (LCFs) to a member of the public (DOE 1999c, page S-22). Additionally, exposures to chemicals under any of the LANL SWEIS alternatives are not expected to result in significant effects to the public (DOE 1999c, page S-22). Consequently, human health impacts to the public from LANL operations do not, by themselves, need further analysis in the CT EIS. However, some operations are examined as a consequence of transferring or conveying land, which may place members of the public in closer proximity to such operations. This same situation is true with regard to some LANL accidents described in the LANL SWEIS. These potential impacts of LANL operations on non-LANL workers or residents on the 10 land tracts are addressed where a potentially viable pathway for exposure may exist. Only two pathways related to LANL operations for offsite human health impacts were identified in the LANL SWEIS. These are air emissions (for example, fugitive dust, stack emissions, and direct radiation from contaminated soils) and water effluents (for example, NPDES discharges for stormwater and process waters).

Bringing a receptor (a recreational user or resident) closer to the source of air emissions may produce higher exposures or doses. Bringing a receptor closer to a source of water effluents will not change the exposure or dose unless the scenario of exposure changes (such as the frequency of drinking water). The CT EIS exposure scenarios are defined as the same used in the LANL SWEIS. Like the air emissions, the LANL SWEIS has evaluated the human health impacts of exposure to water effluents (DOE 1999c). Water effluents in the form of NPDES-permitted discharges are generated on one of the land tracts (TA 21) (DOE 1999c, Chapter 4, Table 4.3.1.3-1).

The assumption about environmental restoration or remediation of all land tracts being completed prior to conveyance or transfer means that the potential sources of radiological or chemical hazards will not be present on the land tracts themselves once they are conveyed or transferred. Therefore, to have a human health impact on the land recipients would require radiological or chemical hazards to be transported to the land tracts from another LANL location. The only pathway that has potential to do that because of the closer proximity to LANL operations is air (via air immersion or inhalation). The airborne pathway is the primary pathway examined in detail in this CT EIS, but only for those operations where the lands to be transferred are close enough to the LANL operations that they could pose a potential risk. The same “closer proximity” situation may be true for some accident analyses also.

The specific methods for calculating radiological doses and LCFs are the same as described in the LANL SWEIS (DOE 1999c). These methods are based upon risk factors and reference values developed by the International Commission on Radiological Protection (ICRP 1977 and ICRP 1991) and the National Research Council (NRC 1990). Information on background radiation was derived from the National Council on Radiation Protection (NCRP) (NCRP 1987). Where applicable, the methods for calculating the exposure and risks to chemicals are the same as described in the LANL SWEIS (DOE 1999c). These methods are based upon standard assessment methodologies, reference doses, and cancer risks (EPA 1991 and EPA 1997a). Exposure factors for ingestion and inhalation are taken from the latest EPA guidance (EPA 1997b).

An evaluation also has been made to determine if tracts lie within one of LANL's one-half mile radiation site evaluation circles, due to one or more LANL operations. These safety circles were intended to be used as planning tools for site developers and other project managers responsible for siting new facilities or operations to inform them of the presence of existing radiation sources and the need to evaluate their proposed action(s) against this information. The concept was defined and required as part of the planning process in LANL's Site Development Plan of 1990 (LANL 1990). This plan states that proposals for new activities or facilities at sites that lie within safety circles must be accompanied, during the siting process, by an evaluation of the potential radiological impacts and possible mitigation actions; the circles themselves are not representative of a particular dose of radiation to site receptors under either normal operations or accident conditions. As part of the human health assessment for the CT EIS, it was determined that four of the 10 subject tracts have portions that are within LANL facility radiation evaluation circles. These four tracts are the DOE LAAO Tract (due to activities at the Health Research Laboratory nearby), the DP Road and Airport Tracts (due to activities at TA 21), and the TA 21 Tract (due to operations both at TA 21 and at the Los Alamos Neutron Science Center [LANSCE] facility located on the next mesa to the south). Maps of the radiation site evaluation circles are provided for these tracts in Chapters 6, 9, 10, and 11 within the discussion of the existing environments for these tracts. The human health analysis included in the CT EIS analysis, by evaluating both chemical and radiological health consequences from normal operations and hypothetical accidents, provides the safety evaluation that must be considered for the conveyance or transfer of the subject tracts.

4.2.12.3 Facility Accidents

Accidents considered for the CT EIS are those presented in the LANL SWEIS, consistent with the DOE's overall approach of relying upon the SWEIS. The methodology for this reliance consists of reviewing the SWEIS accidents, determining which are applicable to the CT EIS, identifying assumptions and data required to analyze the applicable accidents, and then assessing the consequences of the applicable accidents.

SWEIS Accidents

The LANL SWEIS presents 30 accidents of four different types. In addition, the DOE added an additional accident scenario in the LANL SWEIS. (In response to public comments, a scenario in which a wildfire sweeps through LANL property was added.) A summary of accidents is provided in Table 4.2.12.3-1.

For some accidents, more than one hypothetical scenario is presented. For example, accident RAD-15 presents a hypothetical fire at the Chemical and Metallurgy Research (CMR) Laboratory (Building 03-29). Two scenarios are discussed: (1) a fire in a single chemical

Table 4.2.12.3-1. Summary of Potential LANL Accidents Considered in the Human Health Analysis

TYPE	NO. OF ACCIDENTS	NO. OF SCENARIOS
Natural Event	4	5
Chemical	6	16
Radiological	16	22
Worker	5	5
Total	31	48

laboratory room and (2) a fire that consumes an entire wing of the CMR Building. The SWEIS presents consequences for each of these two scenarios.

Applicable Accidents

This pool of 31 accidents was then reviewed for applicability to the proposed disposition of land tracts (see Table 4.2.12.3-1). Some scenarios were screened either because no members of the public would be involved; the scenario is not a credible accident; or the tract is too distant to be affected by the accident. As explained below, a total of 13 accidents and 20 scenarios do not affect any of the land tracts.

Five of the 31 accidents and five of the 48 scenarios involve only LANL workers. For example, accident WORK-04 in the LANL SWEIS evaluates the inadvertent exposure of one or more workers to electromagnetic radiation (x-rays, accelerator particle beams, lasers, or radiofrequency sources). These accidents affect only LANL employees, and have no public consequences. Accordingly, they need not be reevaluated for the CT EIS.

Five of the SWEIS accidents have frequencies of less than 10^{-6} per year, or less than once in a million years:

- **RAD-04:** Inadvertent detonation of a plutonium-containing assembly at the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility
- **RAD-06:** Aircraft crash into the Radioactive Materials Research, Operations, and Demonstration (RAMROD) Facility
- **RAD-10:** Dropping of a degraded storage container at Plutonium Facility (PF)-4
- **RAD-11:** Containment breach after detonation of a plutonium-containing assembly at the DARHT
- **RAD-14:** Plutonium release due to ion-exchange column thermal excursion (three scenarios)

In recognition of the different purposes that accident analyses play in the LANL SWEIS, the CT EIS evaluates reasonably foreseeable accidents that have a frequency in excess of 10^{-6} per year. For the CT EIS, these five accidents (seven accident scenarios) will not be reevaluated.

Next, the effects of three of the chemical accidents (six scenarios) do not reach any of the 10 land tracts proposed for disposition. Before reaching the tracts, the chemical plume will have decreased in concentration to the point that the chemical is, at worst, an irritant. Therefore, it no longer presents a health concern. The three chemical accidents are:

- **CHEM-04:** Release of toxic gas from a single container at 54-216
- **CHEM-05:** Release of toxic gas from multiple containers at 54-216
- **CHEM-06:** Chlorine gas release from outside the Plutonium Facility

None of the radiological accidents can be screened on the basis of distance from the accident to the tract. Each radiological accident requires an estimation of the maximally exposed individual (MEI) dose, collective dose, and excess LCFs for each of the 10 tracts of land proposed for disposition.

Finally, two of the radiological scenarios from accident RAD-09 were screened as unnecessary to evaluate. Accident RAD-09 evaluates four separate scenarios for dropping or puncturing a drum of transuranic waste. Two scenarios assume cleanup requires 24 hours, and two assume cleanup is accomplished in 1 hour. The 24-hour cleanup scenarios are obviously bounding, because drum contents are available for wind dispersion for a much longer period of time.

These were the only RAD-09 scenarios evaluated.

Assumptions and Data Used in Accident Assessments

Some information was common to the assessment of consequences of all remaining accidents (18) and accident scenarios (28). Distances from each accident to each of the 10 tracts of land proposed for disposition were required. Two distances were measured for each land tract: (1) the distance from the accident to the closest point of the tract and (2) the distance from the accident to the mid-point of the tract. These distances were assumed to be the same for the Miscellaneous Site 22 and Miscellaneous Manhattan Monument Tracts, but differed significantly for the larger tracts, such as the Rendija Canyon and TA 74 Tracts.

Another piece of information essential to assessing accident consequences is the assumed occupancy or population after development (the number of people potentially in the path of the chemical or radiological plume). These data are based upon development scenarios assumed for the 10 tracts subsequent to disposition of ownership, as set forth in the land use sections of this CT EIS. Maximum assumed occupancy was then weighted for assumed average occupancy. For example, Rendija Canyon would house an estimated 3,500 new residents if developed under one of the contemplated scenarios. Should a LANL accident occur during the day, most of these residents would not be at home, so that the consequences of the accident would be much smaller. Similarly, the Airport Tract may be developed commercially, with total estimated employment of 3,100. Should a LANL accident occur during the evening, however, most of these workers would have already gone home, so that the consequences of the accident would be much smaller. Accordingly, weighted occupancy or population was used to assess consequences. Data for each of the tracts are summarized in Table 4.1.4-1.

Assessing the Consequences of Applicable Chemical Accidents

Three chemical accidents were examined for additional potential public consequences in the LANL SWEIS. Two evaluation parameters were used in this examination:

- **ERPG-2:** Emergency Response Planning Guideline, Level 2. This is the maximum airborne concentration of a chemical below which nearly all individuals could be exposed for 1 hour without experiencing or developing irreversible or other serious health effects or symptoms that could impair their ability to take protective action.
- **ERPG-3:** Emergency Response Planning Guideline, Level 3. This is the maximum airborne concentration of a chemical below which nearly all individuals could be exposed for 1 hour without experiencing or developing life-threatening health effects.

Chemical accident consequences are expressed in terms of the number of people exposed to air at either of these two chemical concentrations. Exposures to air at lower concentrations result only in irritation or odor detection, and do not present a health threat. The key to analysis of chemical accident consequences, therefore, is estimating the distances traveled by chemical plumes at or above ERPG-2 and ERPG-3 concentrations. These distances were estimated in the LANL SWEIS, using the ALOHA™ computer code.

The ALOHA™ code is designed to be used for emergency responders in the case of chemical accidents. The code predicts the rate at which chemical vapors may escape to the

atmosphere from broken gas pipes, leaking tanks, and evaporating puddles, and predicts how the resulting chemical gas cloud disperses horizontally and vertically into the atmosphere. ALOHA™ predicts the distances traveled by the chemical plume before concentrations drop below ERPG-3 and ERPG-2 concentrations. More detailed information about the ALOHA™ code and consequences of the chemical accidents are presented in Appendix G of the LANL SWEIS (DOE 1999c).

The assessment of consequences for the proposed disposition of tracts uses the ERPG-2 and ERPG-3 distances predicted by the ALOHA™ code, as stated in the SWEIS. These chemical plume distances were first compared to the distance between the land tract and the accident location. If the tract fell within the distance estimated for plume travel, then the number of additional public members affected by the accident was assumed to equal the weighted average occupancy of the tract.

Assessing the Consequences of Applicable Radiological Accidents

Three consequence parameters were estimated for each of the 13 applicable radiological accident scenarios: (1) MEI dose at each tract, (2) collective dose for each tract, and (3) excess LCFs at each tract. Estimations start with output data from the LANL SWEIS accident analyses and data generated by running the MACCS 2 computer code.

The MACCS 2 computer code uses a Gaussian plume model and source-term input to predict atmospheric dispersion and ground deposition of radionuclides from an accident that releases a plume of radioactive materials into the atmosphere. The radioactive aerosols and/or gases are presumed to be transported by prevailing winds, while dispersing horizontally and vertically in the atmosphere. MACCS 2 predicts doses at specified locations, ground contamination at specified locations, and collective dose. More detailed information about the MACCS 2 code and consequences of the radiological accidents are presented in Appendix G of the LANL SWEIS (DOE 1999c).

For most accidents, the LANL SWEIS provides information (generated by the MACCS 2 code) about plutonium ground concentration as a function of distance. The method used to estimate MEI doses at the land tracts, therefore, uses this ground contamination data. The method assumes that the relationship of ground contamination versus distance is the same as that for dose versus distance (that is, both decrease as a function of distance from the accident location at the same rate). Thus, if one knows ground concentration and dose at a reference location, and the distance from the accident to the tract, then dose at the tract can be estimated by ratio. MEI doses were estimated through the following steps:

- Distances from the accident location to the nearest point of each land tract were calculated.
- A reference location was selected, one for which the LANL SWEIS had calculated an MEI dose.
- Mean ground contamination level was estimated for this reference location.
- Mean ground contamination level was estimated for each land tract.
- MEI dose was estimated for each land tract.

Tract collective dose was estimated by calculating a mid-point MEI dose at each tract of land for each of the 13 applicable accident scenarios. The methodology was the same as used when estimated MEI dose except that distance was that from the accident to the mid-point of each land tract. This mid-point dose was then multiplied by the weighted average tract population or occupancy to calculate collective tract dose, from which excess LCF was calculated. Excess LCF is the

mid-point MEI dose multiplied by 0.0005 latent cancers per Roentgen equivalent man (rem) of dose.

Assessing the Consequences of Applicable Natural Event Accidents

Five natural event accident scenarios triggered by natural phenomena (four earthquakes and one wildfire) are postulated in the LANL SWEIS. These are referred to in the SWEIS as "site-wide accidents" but are identified as "natural event accidents" in the CT EIS. Three of the four earthquake scenarios were not reevaluated for the CT EIS. Instead, only the most severe earthquake is reevaluated, along with the wildfire accident. For these two accidents, the consequences of both chemical and radiological releases were examined.

Sources (such as buildings) of chemical releases are identified for the LANL SWEIS. For most buildings, consequences are evaluated under both conservative (typical) and adverse weather dispersion conditions. For both of these accident scenarios, the SWEIS estimates the ERPG-2 and ERPG-3 distances and the number of people that would be exposed to ERPG-2 and ERPG-3 concentrations. Potential consequences subsequent to land disposition are evaluated, therefore, by determining if any of the land tracts lie within these distances.

Sources (such as buildings) of substantial radiological releases also are identified for the LANL SWEIS. MEI doses are estimated for some of these sources. These same MEI doses are reestimated for each of the 10 tracts of land proposed for disposition (regardless of whether the tract would be developed). The method used was to compare the material-at-risk (MAR) or source term from each building to the MAR or source term of a RAD-only accident, then ratio the MEI dose at each land tract. Collective dose and excess LCFs were estimated for the land tracts in a similar ratio fashion.

4.2.13 Environmental Justice

Pursuant to Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (59 *Federal Register* [FR] 7629 February 16, 1994), this section identifies and addresses any disproportionately high and adverse human health or environmental effects on minority or low-income populations from implementing the Proposed Action Alternative.

Potential environmental justice impacts are assessed using a phased approach. This approach established three thresholds for assessing whether environmental justice issues are likely to arise as a result of proposed DOE activities. The following three questions form the framework and establish the thresholds for the phased approach to environmental justice analysis.

- Are there any potential impacts to human populations?
- Are there any potential impacts to minority or low-income populations?
- Are potential impacts to minority or low-income populations disproportionately high and adverse?

For environmental justice impacts to occur, there must be high and adverse human health or environmental impacts that disproportionately affect minority or low-income populations.

Environmental justice guidance developed by the CEQ defines "minority" as individual(s) who are members of the following population groups: Native American (American Indian) or Alaskan Native, Asian or Pacific Islander, Black, or Hispanic (CEQ 1997). Minority populations are identified when either the minority population of the affected area exceeds 50 percent, or the percentage of minority population in the affected area is meaningfully greater than the minority

population percentage in the general population or other appropriate unit of geographical analysis. Low-income populations are identified using statistical poverty thresholds from the Bureau of the Census (Census 1992).

Environmental justice impacts become issues of concern if the proposed activities result in disproportionately high adverse human and environmental effects to minority or low-income populations. Disproportionately high and adverse human health effects are identified by assessing the following three factors to the extent practical:

- Whether the health effects, which may be measured in risks or rates, are significant (as employed by the NEPA) or above generally accepted norms. Adverse health effects may include bodily impairment, infirmity, illness, or death.
- Whether the risk or rate of exposure by a minority or low-income population to an environmental hazard is significant (as employed by the NEPA) and appreciably exceeds or is likely to appreciably exceed the risk or rate to the general population or other appropriate comparison group.
- Whether health effects occur in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

Section 4-4 of the Executive Order (59 FR 7629, February 16, 1994) directs Federal agencies "whenever practical and appropriate, to collect and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence and that federal governments communicate to the public the risks of these consumption patterns."

Potential impacts to cultural resources such as TCPs also could have a disproportionate and adverse effect on minority or low-income populations in the area. If TCPs are present on the tracts or in adjacent areas, they could be impacted by the conveyance or transfer and subsequent land uses. Potential impacts to these cultural resources (for example, destruction, alteration of setting, or loss of access to religious sites) also could have human health, economic, or social effects on minority or low-income populations. Depending on the intensity of these effects, impacts may be disproportionately high and adverse, and thus, have environmental justice consequences.